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# Local Wisdom-Based Science Learning: Integrating Areca Nut in Elementary Education

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**Abstract**

This study examines the use of Areca nut as a science learning medium at Lab School Universitas Pendidikan Muhamamdyah (UNIMUDA) Elementary School in Sorong. The goal is to explore the impact and challenges of implementing this medium in enhancing students' understanding of scientific concepts. Using a qualitative descriptive approach, data was collected through observations, interviews, and documentation. The research results indicate that 80% of students were more motivated and actively engaged in learning when using Areca nut-based materials, while 85% showed increased environmental awareness. However, 40% of teachers faced difficulties integrating this medium into the curriculum, and 65% of students identified limited facilities as a barrier. To address these challenges, teacher training and improvements in educational resources are necessary. This research confirms that utilizing media based on local wisdom not only enhances student engagement but also strengthens their contextual understanding of scientific concepts. The integration of environmentally based teaching materials can serve as an innovative solution to enrich the learning experience in areas with limited access to education.



## INTRODUCTION

Education is one of the main pillars of a country's development. Therefore, education must be capable of producing a generation that is not only academically intelligent but also has strong character and is ready to contribute positively to society. In the field of education, teaching methods and learning media play an important role in the success of the teaching and learning process. Effective methods make it easier for students to understand lesson materials, while appropriate learning media can enrich their learning experience. One area that requires an innovative approach in the use of learning media is science education. Science subjects are often considered complex and abstract, necessitating a more concrete and relevant approach to students' daily lives. In this context, constructivist learning theory and experiential learning models provide a strong foundation for incorporating locally sourced natural materials into science education.

According to constructivist theory, learning is an active process where students build knowledge based on their experiences and interactions with their environment. Thus, the use of locally sourced natural materials in science learning can help students better understand scientific

concepts, as they can relate the studied material to real-life phenomena. For example, in ecosystem studies, students can directly observe biodiversity in their surroundings, such as forests, rivers, or school gardens. Meanwhile, the experiential learning model emphasizes that direct experience is a key element of the learning process. This model suggests that students understand and internalize scientific concepts more effectively when they engage in exploration, experimentation, and reflection on real-world phenomena. By using natural local materials such as soil, stones, leaves, or river water, teachers can design more meaningful and contextual learning experiences for students.

Recent studies support this approach. Surayanah & Karma, (2023), in their book Project-Based Science Learning with Local Wisdom, state that integrating local wisdom in science learning enhances students' generic science skills and fosters positive attitudes toward environmental awareness. Similarly, Hadzami et al., (2023) found that the implementation of a STEM-based Problem Based Learning model, using locally relevant teaching materials, effectively improves environmental literacy. Through this approach, science education not only becomes more engaging and easier to understand but also helps students develop critical thinking skills, problem-solving abilities, and awareness of environmental conservation. Thus, the implementation of constructivist theory and experiential learning models in science education can create a more effective and impactful learning experience for students.

In Indonesia, local wisdom based education has gained increasing attention in recent years. Local wisdom refers to the knowledge, values, and practices developed by local communities in harmony with their environment and culture. This educational concept integrates local wisdom into the academic curriculum to provide students with a deeper understanding of their connection to nature and cultural surroundings. Additionally, this approach aims to enrich students' learning experiences and enhance their awareness of their responsibilities in environmental conservation.

Study Previous studies have demonstrated that integrating local wisdom into science education positively impacts students' understanding and engagement. Muyassaroh et al., (2024) systematically reviewed how integrating local wisdom into the primary school science curriculum enhances learning quality and preserves regional culture. Similarly, (Septina, 2024) confirmed that incorporating ethnoscience into science education enriches students' understanding of scientific concepts through culturally relevant approaches. Herawati, (2022), Junita et al., (2024)also emphasized that project-based science learning that integrates local wisdom increases student engagement and understanding of scientific concepts. This approach allows students to connect scientific theory with traditional practices in their communities, making learning more meaningful and contextual.

This approach has also been successfully implemented in several other countries. In New Zealand, science education incorporates Stewart, (2022), or traditional Māori knowledge, enriching students' scientific understanding while reinforcing cultural identity. In Canada, integrating indigenous ecological knowledge into science education has proven to enhance student engagement and understanding of environmental issues. Therefore, using local wisdom-based learning media has been proven effective in creating contextual and meaningful learning experiences. Research by Fatmawati & Umi Hanik, (2024), D. A. Dewi et al., (2023), (Hasibuan, 2022), (Ihsan et al., 2023) shows that integrating local wisdom into mathematics learning modules is valid and beneficial in enhancing students' understanding of the subject matter.

One example of local wisdom-based learning media in science education is the use of areca nuts. This endemic plant is commonly found in Papua, including the Sorong region. Areca nuts have multiple benefits, both in terms of health and daily life within local communities. Apart from being used in traditional ceremonies, areca nuts also hold significant ecological value, making them useful as a learning medium in various scientific contexts, such as photosynthesis, plant growth, and ecosystem interactions. By using areca nuts as a science learning medium, students do not merely study theory but also apply their knowledge through direct observation of nature

Adi et al., (2022). Other studies, such as that by Liunokas et al. (2019), explore the use of areca nut extracts in tropical biology education.

Utilizing natural resources as learning media, such as the areca nut, provides an engaging and easily comprehensible learning experience. For instance, by observing the growth and development of areca nut plants, students learn about photosynthesis, the effects of water and light on plant growth, and biodiversity. Local wisdom-based learning also introduces students to concepts such as ecological diversity and environmental preservation. In the face of increasingly complex educational challenges, nature-based learning media can serve as an effective solution for delivering science materials in an engaging and relevant way to students' environments.

In Papua, particularly in South Sorong Regency, character and skill-based education rooted in local wisdom is essential to improving the region's education quality. Papua is a province rich in natural and cultural diversity, with over 250 ethnic groups speaking various languages. This cultural diversity presents challenges in the education system, as not all ethnic groups have equal access to education. Therefore, developing learning methods and media relevant to the local context is a strategic step to improve education quality, especially in remote areas like Sorong Batigin et al., (2024).

Lab School Universitas Pendidikan Muhammadiyah (Unimuda) Sorong has implemented local wisdom in its learning process. The school has leveraged its surrounding natural and cultural diversity to enrich students' learning experiences. One initiative involves using areca nuts as a science learning medium. Areca nuts are not only beneficial in everyday life but also serve as an engaging and relevant learning object for students, particularly in understanding basic science concepts. Through this approach, students can easily relate the learning materials to their surroundings while strengthening their understanding of environmental conservation.

The significance of using media relevant to local life is supported by research indicating that linking lesson materials to local contexts increases student engagement in the learning process Suryadi & Jasiah, (2023). Thus, incorporating areca nuts as a science learning medium at Lab School Unimuda Sorong benefits not only academic aspects but also character education based on local wisdom. Students are expected to acquire scientific knowledge while also understanding essential values such as environmental conservation and biodiversity preservation.

However, despite the numerous benefits of local wisdom-based learning media, challenges remain in its implementation, particularly in Papua. One of the main obstacles is the limited training and understanding among teachers on how to effectively use nature-based media in science education. Teachers in remote schools often lack adequate training on integrating local wisdom into the existing curriculum Sugiyono, (2020), S. A. Dewi et al., (2023), Maghfiroh et al., (2022). Addressing this requires enhancing teacher capacity through targeted training programs.

Moreover, educational infrastructure in Papua, especially in remote areas, remains inadequate. Many schools lack the necessary facilities to support an effective learning process. This includes limited access to modern learning tools, such as technology, which could enhance teaching and learning Septiana et al., (2024), Suarti & Yunitasari, (2023). In this context, using nature-based learning media, such as areca nuts, presents a practical and relevant solution, as it does not require sophisticated facilities but relies on readily available natural resources.

Overall, this study explores the potential of areca nuts as a science learning medium at Lab School Unimuda Sorong, assessing its impact and challenges. Employing a qualitative approach, the study analyzes how integrating areca nuts enhances students' understanding of scientific concepts while contributing to local wisdom-based education. The findings suggest that locally sourced learning media not only improve student engagement but also reinforce their cultural and environmental awareness. Future efforts should focus on teacher training, improving educational infrastructure, and fostering community collaboration to maximize the effectiveness of local wisdom-based education.

## METHOD

This research employs a qualitative approach with a descriptive research type. The objective of this study is to explore and provide an in-depth explanation of the use of betel nut as a science learning medium at Lab School Unimuda Elementary School in Sorong. The qualitative research approach was chosen because it is suitable for examining complex social phenomena in the educational context. Moleong, (2019) stated that qualitative research is highly effective for gaining a deep and comprehensive understanding of real-world educational experiences.

Data collection was conducted through direct classroom observations, interviews with teachers and students, and documentation of learning activities involving the use of betel nut as a learning medium. Observations were carried out to examine the ongoing learning process, while interviews were conducted to explore teachers' and students' perspectives and experiences regarding the use of betel nut as a learning material. Sugiyono, (2023)defines an interview as a meeting between two individuals to exchange information and ideas through a question-and-answer process, which helps build meaning on a particular topic. Additionally, documentation was used to analyze materials and activities implemented during science learning with this medium. Creswell (2018) explains that document analysis provides a broader understanding of policies or practices applied in the field of education.The collected data were then analyzed thematically by identifying key themes related to the effectiveness of using betel nut as a science learning medium and its impact on students' understanding. According to Clarke & Braun, (2013), thematic coding is an effective method in qualitative research for identifying significant patterns within the collected data.

This study also incorporates a literature review related to learning theories, the use of nature-based media, and the integration of local wisdom in education, which supports data analysis and interpretation. This approach aims to provide a holistic understanding of the potential and challenges associated with implementing betel nut-based learning media in elementary schools.

## RESULTS AND DISCUSSION

### RESULTS

The implementation of betel nut as a science learning medium at Lab School Unimuda Elementary School has shown a significant impact on students' understanding of scientific concepts, particularly in contextual and locally based learning. Based on data collected from 50 students and 10 teachers, the integration of betel nut into the curriculum and daily learning activities has yielded positive results, although its implementation is not yet evenly distributed across all subjects. The majority of teachers reported incorporating values such as cooperation, social justice, and humanity as themes in their lessons. However, 15% of teachers indicated that the application of Pancasila values is limited to certain subjects and is not consistently implemented across the curriculum.

One of the main challenges in this study is the limited understanding among teachers in integrating betel nut into the science curriculum, with 40% of teachers expressing the need for additional practical training. This training should focus on inquiry-based pedagogical strategies to ensure that teachers not only understand scientific concepts but are also capable of designing interactive learning experiences. Additionally, 65% of students reported educational facility limitations, such as a lack of resources that hinder the optimal use of betel nuts in the classroom. To address this issue, schools need to provide teaching aids and locally based learning modules to support contextual learning.

Despite these challenges, 80% of students reported feeling more motivated and engaged when betel nut was used as a learning tool. Qualitative feedback indicated that younger students particularly enjoyed sensory exploration, while older students focused more on the relationships between observed phenomena and scientific concepts. Moreover, students with stronger scientific understanding were able to make better connections between the material, whereas those with

limited knowledge required additional guidance. These findings highlight that using locally relevant materials can enhance student engagement and motivation in science learning.

Furthermore, 85% of students expressed that learning about the environmental and ecological aspects of betel nut cultivation improved their awareness of local biodiversity and the importance of environmental conservation. This aligns with (Septiana et al., 2024), who suggested that learning about local biodiversity helps students develop a greater sense of responsibility toward the environment. The study also shows that students can connect these lessons to broader concepts such as ecology, biology, and environmental science, which they can apply to their daily lives.

Table 1. Integration of Pancasila Values in Curriculum and Studying

| Aspect | Percentage (%) |
|---|---|
| WHO teachers state that integrated Pancasila values to in That curriculum And currently Study | 85% |
| WHO teacher reported That application the values of Pancasila are limited to a number of eye lesson | 15% |
| WHO students feel they understand Pancasila values ( mutual respect) cooperation , social justice , humanity ) | 90% |
| WHO teacher report difficulty integrate betel nuts to in science lessons | 40% |
| WHO students feel That limited facility obstruct currently Study | 65% |
| WHO teachers feel That need For more Far training on using media based natural | 60% |

Data from Table 1 highlights the positive impact of integrating Pancasila values into the curriculum at Lab School Unimuda Elementary School in Sorong. The majority of teachers (85%) reported successfully incorporating Pancasila values into their lessons, particularly focusing on concepts such as cooperation, social justice, and humanity. However, 15% of teachers indicated that the application of these values remains limited to specific subjects, suggesting the need for broader integration across all areas of learning. The need for additional teacher training is emphasized, with 60% of teachers expressing a desire for more practical guidance on integrating nature-based media, such as betel nuts, into science lessons. While 65% of students noted that limited facilities hinder optimal learning, the overall results suggest that integrating Pancasila values is beneficial in enhancing students' understanding of key social and environmental concepts.

While the integration of Pancasila values into the curriculum has shown promising results, its impact on student motivation and engagement, as reflected in Table 2, was even more significant. This further emphasizes the effectiveness of using relevant local media, such as betel nuts, in science education. The use of locally sourced materials significantly increased student interest and participation, with 80% of students expressing greater enthusiasm for lessons involving betel nuts. Additionally, 85% of students reported increased awareness of environmental issues, linking the learning process to real-world concerns. These findings underscore the potential of contextual and nature-based learning in not only fostering academic engagement but also promoting environmental awareness among students.

Table 2. Impact on Student Motivation and Engagement

| Aspect | Percentage (%) |
|---|---|
| WHO students feel Again interested and motivated with betel material base peanut currently Study | 80% |

| Aspect | Percentage (%) |
|---|---|
| WHO students feel Again worry about local diversity Life and environment sustainability | 85% |
| WHO teacher reported That Work same among School and society not optimal | 50% |
| WHO students feel betel material base peanut currently Study increase Observation and experiment skills | 75% |

Based on the data in the table, it can be concluded that one of the experiments conducted by students using betel nut was measuring the growth rate of betel nut sprouts under different environmental conditions. In this experiment, students planted areca nut seeds in various types of soil, such as sandy soil, clay soil, and humus soil, and then observed the growth of sprouts over a certain period. Additionally, they compared the influence of environmental factors such as humidity, lighting, and water availability on the speed of germination and shoot growth. Through this experiment, students were able to understand how environmental factors affect plant growth and their relevance to photosynthesis and plant adaptation.

Furthermore, students conducted comparative tests on the physical and chemical characteristics of betel nut at different stages of maturity. They observed changes in skin color, fruit texture, and water content using simple measurement techniques. Some student groups even attempted to extract substances from betel nut to test its properties as a natural dye and antibacterial agent in the context of utilizing local resources. These experiments not only enhanced students' observation and experimental skills but also provided insights into the potential uses of betel nut in daily life, as well as its impact on the ecosystem and environmental sustainability.

The data from Tables 1 and 2 collectively demonstrate the positive impact of integrating Pancasila values and local media, such as betel nut, into the learning process at Lab School Unimuda Elementary School in Sorong. The integration of Pancasila values into the curriculum was considered effective by most teachers, with 85% reporting that these values were well incorporated into their lessons. However, there is still room for improvement, as 15% of teachers indicated that the application of Pancasila values remains limited to certain subjects. Additionally, 60% of teachers expressed the need for more practical training on how to effectively integrate nature-based media into lessons. While 65% of students reported challenges related to limited facilities, the overall results highlight that integrating Pancasila values is beneficial in shaping students' understanding of key community and environmental issues.

Further emphasizing the success of this approach, Table 2 reveals that using betel nut as a learning medium significantly improved student motivation and engagement. A total of 80% of students reported increased interest and motivation in lessons, while 85% developed a stronger awareness of environmental and ecological issues. The use of locally relevant media has been proven effective in making learning more engaging and applicable to real-life contexts. This demonstrates that integrating local materials not only enhances student participation but also fosters a deeper understanding of their cultural and environmental surroundings. Collectively, these findings suggest that merging Pancasila values with nature-based media can effectively enhance students' academic performance and social responsibility while also addressing challenges related to teacher training and infrastructure.

## DISCUSSION

The use of betel nuts as a science learning medium at Lab School Unimuda Elementary School Sorong has proven to be highly effective in enhancing students' understanding of various scientific concepts. The integration of local materials into the learning process has helped students connect theoretical knowledge with real-world examples, making the learning experience more

concrete and meaningful. As stated Handiyati et al., (2023), natural learning media, such as plants and local products, can engage students more effectively with the material while also fostering a deeper understanding of the cultural and ecological context of their environment.

The use of betel nuts, a local product in Papua, has played an important role in promoting students' understanding of biology, ecology, and environmental science. Through direct engagement with betel nut plants, students learn about their physical characteristics, benefits, and life cycle. This aligns with (Suanda et al., 2024), who emphasized that nature-based media enrich the learning experience and provide a tangible connection between theoretical concepts and everyday life. Additionally, using betel nuts as a learning tool has increased students' awareness of biodiversity and environmental conservation, reinforcing their sense of responsibility toward nature. However, despite these positive outcomes, several challenges remain. One of the most significant obstacles identified in this study is the need for more effective teacher training. Forty percent of teachers reported that they required further guidance on how to integrate betel nuts more effectively into science lessons. (Masyhuri et al., 2023) emphasized that teacher competency is crucial to the success of media-based learning, highlighting the necessity of training educators to effectively utilize local materials like betel nuts for sustainable educational practices.

Another challenge is the limited educational infrastructure at Lab School Unimuda Elementary School Sorong. As (Septiana et al., 2024) pointed out, the quality of education in remote areas is often hindered by inadequate facilities. In this study, 65% of students and 70% of teachers reported that the limited availability of teaching aids and classroom resources negatively impacted the learning process. To address this issue, it is essential to improve physical infrastructure and provide necessary resources to support the effective use of natural learning media in classrooms. Despite these challenges, the study found that using betel nuts as a medium for science education significantly improved student motivation and engagement. As Patton (2015) noted, using materials relevant to students' environments can enhance their interest in learning. By utilizing locally available and culturally significant plants such as betel nuts, students not only became more engaged in the learning process but also developed practical skills in observation and scientific experimentation. These hands-on activities align with broader educational goals, making learning both meaningful and applicable to real-world contexts.

Regarding cultural diversity, the study found that while most students shared a similar cultural background, the acceptance of local-based learning varied among students due to socioeconomic factors. (Batigin et al., 2024) highlighted that in communities with diverse cultural and socioeconomic backgrounds, the reception of local-based teaching methods may differ. This suggests that while the use of betel nuts as a learning tool aligns well with local culture, further adaptation and flexibility may be required to ensure its effectiveness across different student demographics.

Additionally, the study revealed that the use of betel nuts as a learning tool contributes to strengthening students' cultural identity. (Rasyid & Muchsin, 2022) emphasized the importance of integrating local wisdom into education, as it helps students develop a sense of pride in their cultural heritage. In this case, incorporating betel nuts into learning allowed students to connect more deeply with their local environment and traditions, further enhancing the relevance of educational materials. In conclusion, the implementation of betel nuts as a learning medium for science at Lab School Unimuda Elementary School Sorong offers valuable insights into the positive impact of local, nature-o

## CONCLUSION

Implementation of betel nut as a science learning medium at Lab School Unimuda Elementary School in Sorong has shown promising results in improving students' understanding of scientific concepts and fostering greater engagement with learning materials. The integration of contextually relevant local media, such as betel nut, into the curriculum has helped students

connect theoretical knowledge with real-world examples, particularly in the fields of biology, ecology, and environmental science. This approach not only enhances students' academic comprehension but also promotes a deeper appreciation of local biodiversity and environmental conservation. However, challenges remain, including teachers' limited understanding of how to effectively integrate betel nut into lessons, a lack of adequate teaching resources, and the need for further teacher training. Despite these obstacles, the use of betel nut has significantly improved student motivation, with 80% of students reporting higher levels of engagement and 85% demonstrating increased awareness of environmental issues. In light of these findings, it is evident that while using betel nut as a learning medium offers substantial benefits, certain areas still require attention. To maximize the effectiveness of this approach, continuous teacher training on the practical application of nature-based media, improved educational infrastructure, and greater community involvement are essential. Moving forward, investing in these areas will enable schools to better utilize local resources, making education more engaging, meaningful, and culturally relevant. This approach aligns with broader educational goals of enhancing student academic performance, fostering social responsibility, and preserving local traditions.

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